

X-Band Antenna Feed Cone Assembly

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The new X-band feed cone assemblies for the DSN 64-m antenna stations are under construction. The feed subassemblies have been completed, and other progress to date is reported.

In support of Viking and future projects, the DSN must provide for X-band signal reception at the three existing 64-m antenna stations. The design of a new feed cone assembly for this purpose was described in Ref. 1.

The feed subassemblies for the three cones have now been completed and are shown in Fig. 1. The top plate, which seals the cone opening and supports the feed without additional members, is shown resting on a wooden frame that serves as a storage and transportation enclosure.

Not yet mounted on the feed assembly is the X-band waveguide switch to select either the feed or a calibrated load for the traveling wave maser. Its mounting plate may be seen at the lower end of the feed.

The lowest component in the feed, which will attach directly to the waveguide switch, is the circular-to-rectangular waveguide transition. This uniform transition is formed by electron-discharge machining of a solid

copper forging with a tool like that shown on the right in Fig. 2.

The tool illustrated is a forming tool that is a copy of a master tool generated on a programmed machine. Several of these tools are used as electrodes to form a transition such as the aluminum test piece also shown in Fig. 2. The transition, when finished, is 10.16 cm (4.000 in.) long and uniformly transforms a 3.477-cm (1.369-in.) diameter circular waveguide into a 3.175×1.587 cm (1.250×0.625 in.) rectangular waveguide.

The next section above the transition is a circular waveguide section that serves as a higher-mode control between the transition and polarizer, which is the third section. Both components are made from solid copper forgings, the polarizer by electron-discharge machining, and the circular waveguide section by conventional machining.

The polarizer is a quarter-wave plate design and is the same as that used successfully in the Operational Time

Sync Microwave Subsystem (Ref. 2), except for dimensional scaling to this frequency band.

The fourth waveguide section is another circular waveguide spacer identical to the second section. Besides providing additional mode control, these two spacer sections, totaling 20.32 cm (8 in.) in length, will provide for future modifications in the feed without greatly increasing its length. For example, rotary joints for the polarizer could be added without changing the overall length by substituting shorter spacer sections along with the new rotary joints.

The feed horn is fabricated in four sections, of which the top three are aluminum for weight reduction and cost savings, and the lower section (seen with a support clamp in Fig. 1) is OFHC copper. The horn is otherwise

identical to that in the Time Sync System (Ref. 2), except that the horn throat was not modified. Thus, the 3.477-cm (1.369-in.) diameter circular waveguide is maintained throughout the feed.

The voltage standing wave ratio (VSWR) of one of the feed assemblies, complete with the transition, is shown in Fig. 3 over a wide bandwidth. The actual operation of these feeds in the near future will be over a narrow band near 8400 MHz.

The internal floors and ladders for the cone assemblies have been fabricated, along with various brackets and panels. Assembly of these parts and the feed subassemblies into the cone shells has begun, with completion scheduled before the end of the first quarter of calendar year 1974.

References

1. Hartop, R. W., "X-Band Antenna Feed Cone Assembly," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. XVII, pp. 131-133, Jet Propulsion Laboratory, Pasadena, Calif., Oct. 15, 1973.
2. Hartop, R. W., "Operational Time Sync Microwave Subsystem," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. VI, pp. 165-167, Jet Propulsion Laboratory, Pasadena, Calif., Dec. 15, 1971.

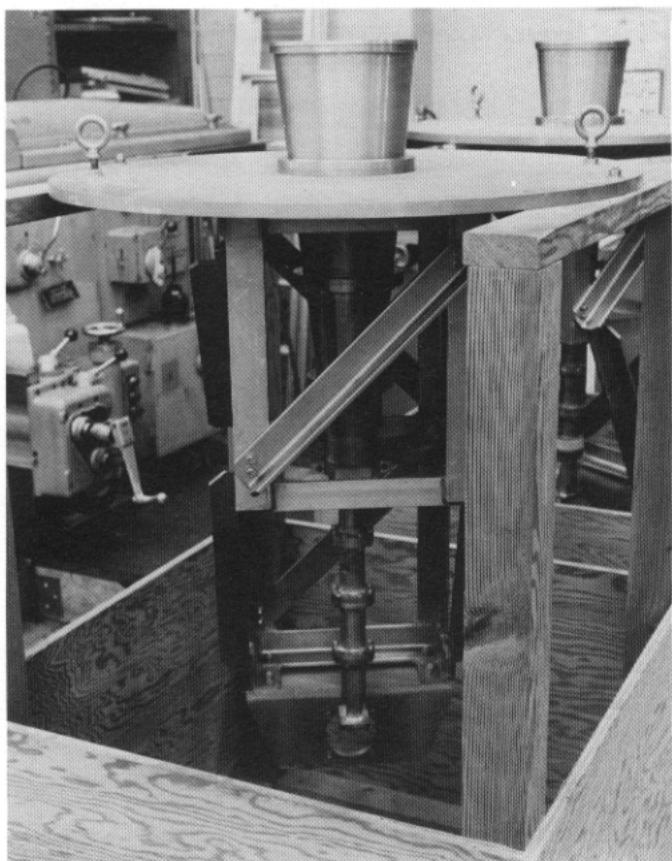


Fig. 1. X-band feed subassembly

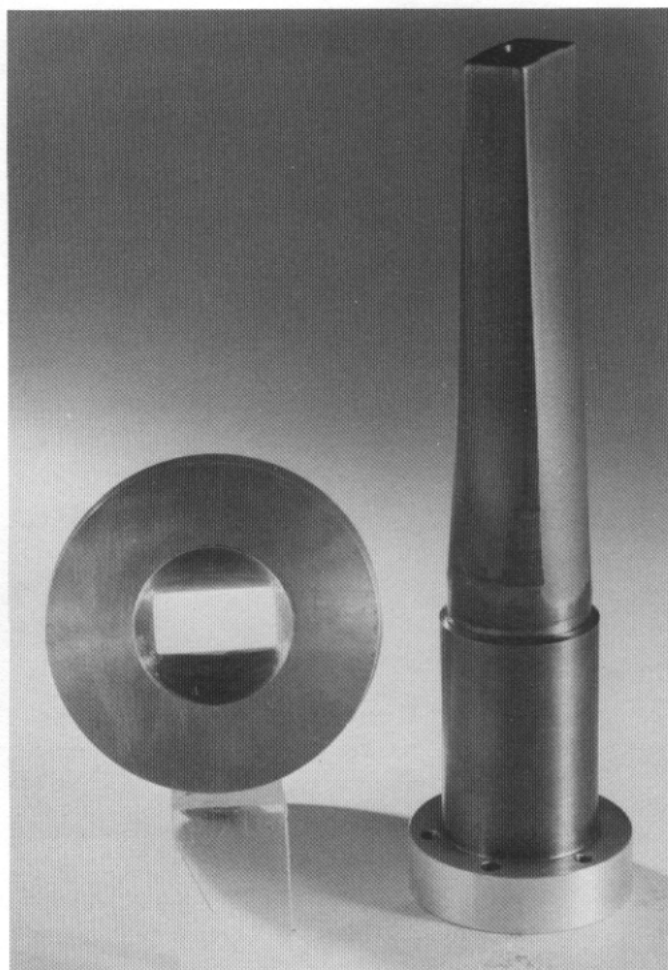


Fig. 2. Waveguide transition and tool

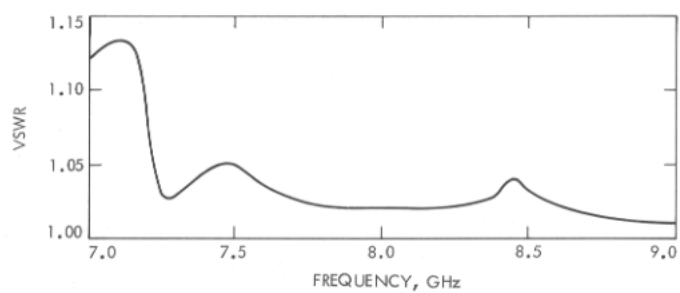


Fig. 3. XRO feed assembly VSWR